

RADIATION SAFETY

A. Introduction

1. This chapter describes the University of New England's management of ionizing radiation and establishes procedures related to control and safe use of radioactive materials. The program and procedures described in this chapter are also intended to facilitate compliance with the University's radioactive material license and applicable state and federal regulations. A copy of the radioactive material license and relevant regulations are available for review in the

- e. Work closely with faculty and staff to coordinate all applicable activities related to the management of the radiation safety program.
- f. Conduct or oversee radiation safety training and documentation thereof.
- g. Receive and monitor shipments of radioactive materials, delivering acceptable incoming shipments to the consignee and insuring that outgoing shipments conform to shipping regulations.
- h. Ensure that radiation monitoring and survey instruments are calibrated annually and operate properly.
- i. Operate a waste management program and document storage and disposal of all radiological waste, including decay in storage, and storage for shipment to licensed commercial vendors.
- j. Prepare procedures for and supervise the cleanup and documentation of spills or other emergency activities.
- k. Stop any unsafe operation or non-compliant activity and deny access of any individual to radiation sources in the interest of safety. Such action must be reported verbally and in writing to the EHS Director immediately.

3. Deans/Vice Presidents:

- a. Implement and ensure compliance with this chapter.
- b. Enforce the procedures set forth in this chapter.
- c. Ensure that personal protective equipment and instruments are working properly and adequately performing their intended functions.
- d. Assist the RSO and EHS Director in solving radiation safety problems.
- e. Provide support as needed to the RSO and EHS Director in order to ensure compliance with existing laws and license requirements (maintenance of records, preparation of reports, etc.).

4. Authorized Users: An Authorized User is a person whose training and experience have been reviewed and approved by the Maine Radiation Control Program, who is named on the license, and who uses or directly supervises the use of licensed material

- a. Ensure Authorized User is up to date on the UNE Radioactive Materials License prior to working with radioactive material.
- b. Provide written confirmation including documented research proving there is no practical less hazardous alternative to the desired radioisotope to be used.
- c. Keep his/her exposure as low as reasonably achievable (ALARA).
- d. Wear assigned personnel monitoring devices in an approved manner.

- e. Responsible for ensuring that the rules and regulations set forth by the RSO and this Safety chapter are implemented.
- f. Clean up minor spills immediately and carry out emergency procedures as required.
- g. Dispose of radioactive waste in the manner approved by this program.
- h. See that sources, containers, and the area are properly labeled and posted.
- i. Maintain required records and inventories.
- j. Prevent unauthorized persons from having access to radiation sources.
- k. Protect service personnel, allowing no maintenance or repairs of area facilities or equipment unless approved by the RSO.
- l.

C. Policies, Practices, Procedures:

1. The ALARA Program:

- a. The ALARA (As Low As Reasonably Achievable) program seeks to keep exposure to radioactive materials as low as reasonably achievable. The program objectives are accomplished in several ways:
- b. Prior to implementation of new procedures, Principal Investigators will confirm in writing, that the proposed material is the least hazardous material available or that alternatives are not reasonable or available.
- c. The UNE Radiation Control Program establishes a threshold that triggers further investigation by the RSO if levels of exposure exceed 10% above maximum permissible exposure values.
- d. The RSO will review procedures periodically and change them when it is apparent that it is both reasonable and achieves a lower possibility of exposure. Changes will be approved by the University-wide Safety Committee and forwarded to the State Radiation Control Office.

2. Application for Authorization:

- a. Authorization must be received before ordering or using radioactive material or equipment containing sealed sources of radioactive material.
- b. The requestor should have a thorough understanding of this safety chapter.
- c. A Request for Authorization to Use Radioactive Isotopes form, should be filled out and submitted to the RSO or the EHS Director and the University-wide Safety Committee (UWSC) for consideration. This form can be found in Appendix M of the Safety Manual or it can be obtained from the RSO.
- d. Revocation of Authorization: Authorization to use radioactive material may be revoked if, in the judgment of the EHS Director, good radiation safety practices are not followed. Items to be considered include:
 - i. Failure to comply with any of the rules put forth by this chapter
 - ii. Frequent spillage or exposure incidences above acceptable limits

b. Authorized users will consult with and receive the approval of the RSO and the EHS Director during the planning stage of an experiment and prior to use of radioactive materials for a new procedure.

c. Authorized Users will document that use of the chosen radioisotope is the least hazardous material available or that alternatives are not reasonable or available.

d. Authorized users will evaluate all procedures before using radioactive materials to ensure that exposures will be kept as low as reasonably achievable (ALARA).

4. Ordering, Receiving, and Accountability of Licensed Materials:

a. The following procedures are in place to ensure accountability of all radioactive materials licensed by the State of Maine that are owned and used by the University, under the control of the Radiation Safety Officer.

b. Packages of radioactive material received at UNE are not expected to exceed Type A quantity¹.

c. All orders for licensed radioactive materials must be authorized by the RSO or EHS Director, who will ensure that possession limits will not be exceeded.

d.

The package has a Radioactive White I, Yellow II, or Yellow III label the package must be monitored for radioactive contamination on its' external surfaces.

v. Whenever licensed materials are in use in a controlled or restricted area, they must be under constant surveillance by the radiation worker to prevent others from becoming contaminated or exposed.

5. Classification of Areas:

a. Restricted Area - An area shall be designated as "Restricted" where there are any radioactive materials used or stored in quantities less than that listed below.

i. A placard with the radiation symbol and the words "CAUTION - RADIOACTIVE MATERIALS" is required to be posted in "Restricted" areas.

b. Radiation Area - An area shall be designated as a "Radiation Area" when a major portion of the body could receive in any one hour, a dose in excess of 5 millirems (0.05 mSv) at 30 centimeters from the source or from any surface that the radiation penetrates.

i. A placard with the radiation symbol and the words: "CAUTION - RADIOACTIVE MATERIALS" must be posted in areas considered to be Radiation Areas³

c. High Radiation Area - An area shall be designated as a "High Radiation Area" when a major portion of the body could receive in any one hour a dose in excess of 100 millirems (1 mSv) at 30 centimeters from the source or from any surface that the radiation penetrates. For appropriate postings for High Radiation areas see 10-144A CMR 220, Part D, 28.

6. Posting and Labeling Requirements:

a. A "NOTICE TO EMPLOYEES" Maine form HHE-845 must be posted in a conspicuous place wherever radioactive materials are used or stored.

b. Emergency Procedures, including a contact list should be posted conspicuously in areas of radioactive material storage or use.

c. Each container of licensed or registered material, including refrigerators and freezers, must be labeled with the radiation symbol and the words, "CAUTION, RADIOACTIVE MATERIAL" or "DANGER, RADIOACTIVE MATERIAL".

7. Maximum Permissible Occupational Dose Limits:

a. Dose Limits for Adult Workers/Minors: Radiation Safety Controls are in place to protect radiation workers and others from occupational exposure. Following is a table of annual dose limits for occupationally exposed individuals.

³ UNE in general, does not expect to store or use enough radioactive material in any of its areas that would reach levels high enough to be designated Radiation Areas.

Annual Dose Limits for Occupationally Exposed Workers

b. Personnel monitoring devices will be required for adult employees expected to exceed the Maximum Permissible Occupational Dose Limits by 10% or more.

c. Minors and declared pregnant workers⁵ will be assigned monitoring devices if likely to receive in 1 year, from sources external to the body, a deep dose equivalent in excess of 1 mSv (0.1 rem). See table below:

Conditions Requiring Monitoring	
Type of Limit	Adult / Minor Dose Limits

k. Surveying - Measure of Residual Contamination:

l. Surveys shall be conducted and results of the surveys and equipment calibration records must be retained for 3 years after the record is made. The following surveys are required:

- i. Conclusion of Sessions: A survey of the workbench and personnel survey must be conducted at the end of each session of experiments (except for Tritium use).
- ii. Survey to be conducted at the conclusion of each procedure and every time the researcher leaves the workspace for any reason. Survey forms can be found by contacting EHS or the RSO for the Radiation Survey Form.
- iii. Bi-Monthly Surveys: A survey of the work-bench will be conducted by Tritium users utilizing the swipe test and scintillation counting. Survey forms can be found by contacting EHS or the RSO for the Radiation Survey Form.
- iv. Quarterly Surveys: Surveys of each laboratory space utilizing radioactive materials will be conducted by the RSO on a quarterly basis.
- v. Random Surveys: Surveys may be needed in order to decommission a piece of equipment or a laboratory space, or to monitor a package containing radioactive material.
- vi. Detection Equipment & Calibration: Instruments and equipment used for quantitative radiation measurements shall be calibrated for the type of radiation being measured at intervals not to exceed 12 months.

9. Laboratory Safety Procedures:

- a. Each laboratory area where radioactive materials are used or stored will follow the safety precautions listed below:
 - i. Wear a laboratory coat or other protective clothing at all times in areas where licensed materials are used. When not wearing the lab coat, it should be kept in a designated area near the restricted area.
 - ii. Wear two pairs of disposable gloves at all times when handling licensed materials.
 - iii. Change gloves often during a procedure to minimize exposure and to avoid spread of contamination.
 - iv. After each procedure, and before leaving the area, monitor hands, shoes and clothing for contamination (performed in a low-background area)
 - v. Do not eat, drink, smoke, or apply cosmetics in any area where licensed materials are used or stored.
 - vi. Wear personnel monitoring devices, if required, at all times while in areas where licensed materials are used or stored.

10. Waste Disposal and Proper Waste Management:

a. **Waste Storage must be Secure:** Storage areas for radioactive waste must be secure at all times to protect against unauthorized removal or unintentional exposure. Storage areas must be posted with the appropriate signage, at a minimum "CAUTION, RADIOACTIVE MATERIALS".

b. **Waste Minimization:** Radioactive waste is extremely expensive to have disposed. Therefore, minimization of radioactive waste is a priority in order to keep costs as low as possible. Waste minimization begins by keeping non-radioactive waste out of the radioactive waste stream. Procedures will be monitored to ensure non-radioactive waste is not being mixed with radioactive waste. Non-radioactive containers and packing materials should have labels removed or destroyed prior to disposal.

c. **Waste Removal from Laboratories:** Movement of radioactive waste from laboratories to storage areas must be performed or at least overseen by the RSO.

i. Authorized Users should contact the RSO in advance to arrange for removal of radioactive waste, unless they have been given express authorization to move waste.

ii. Routes of delivery of radioactive waste to the appropriate storage area should be as short and direct as possible. Occupational and public exposure must be taken into account in considering the best possible delivery route.

iii. Each delivery of radioactive waste to storage areas must be documented appropriately.

d. **Temporary Storage of Radioactive Waste Awaiting Shipment:**

i. Long-lived waste (greater than 120 day half-life) will be stored on site until there is enough to warrant a cost effective shipment offsite.

ii. Solidify liquid radioactive waste - All waste planned for shipment must be in the form of solid waste.

Liquid waste planned for shipment offsite will be solidified utilizing an absorbent material such as vermiculite or clay.

All solidified waste will be double bagged.

Vials of scintillation waste may be placed in absorbent material. Caps may be left on the vials, as long as they are crushed in the waste storage room, prior to being shipped.

The volume of solid radioactive waste should be minimized to the greatest extent possible. Therefore all waste will be crushed whenever feasible prior to final shipment.

Solid waste will be shipped by a licensed hazardous material transporter, and transferred to an authorized recipient as provided by D. 38 of the Maine Rules Relating to Radiation Protection or the U. S. Department of Energy.

e. Decay in Storage (DIS): Liquid or solid wastes with a half-life of 120 days or less may be decayed (under supervision of the RSO) for 10 half-lives and then disposed as non-radioactive waste⁸ .

i. Containers - DIS waste must be stored in suitable, well marked containers that provide adequate shielding⁹. They must also be of appropriate size to make transport as easy and efficient as possible. Containers will be pre-approved by the RSO.

disposal as ordinary rubbish or wastewater (after it has been determined that it is not a hazardous waste).

b.

a.

4. Receipt, Transport, Storage, and Disposal Records: Shall be retained until the license is terminated.

5. Radioactive Material Use Log: Will be entered into the RSO inventory records. These records will be kept for as long as the material is possessed or until 3 years after transfer or disposal.